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Attorney's Docket No. **USG-3325**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

J0915 U.S. PTO
09/718755
11/22/00

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of inventor(s):

MARK H. ENGLERT

WARNING: Patent must be applied for in the name(s) of all of the actual inventor(s). 37 CFR §1.41(a) and §1.53(b).
For (title):

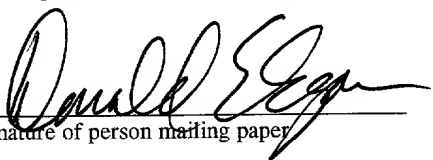
ACOUSTICAL TILE CONTAINING WET-STRENGTH RESIN

CERTIFICATION UNDER 37 CFR §1.10

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this date, November 22, 2000, in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EK317455225US, addressed to: Box PATENT APPLICATION, Commissioner of Patents and Trademarks, Washington, D.C. 20231.

DONALD E. EGAN

Type or print name of person mailing paper


Signature of person mailing paper

NOTE: Each paper or fee referred to as enclosed herein has the number of the "Express Mail" mailing label placed thereon prior to mailing. 37-CFR §1.10(b).

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 CFR §1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

1. **Type of Application** This new application is for a(n)
(*check* one applicable item below)

☒ Original (non-provisional)

☐ Design

☐ Plant

WARNING., Do not use this transmittal for a completion in the U.S of an International Application under 35 U.S.C. §371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.

WARNING: Do not use this transmittal for the filing of a provisional application.

NOTE.- If one of the following 3 items apply then complete and attach **ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED** and a **NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION**.

☐ Divisional.

☐ Continuation.

☐ Continuation-in-part (C-1-P).

2. **Benefit of Prior U.S. Application(s)** (35 U.S.C. §119(e), 120, of 121)

NOTE.- If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach **ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED**.

WARNING., If an application claims the benefit of the filing date of an earlier filed application under 35 U. S.C 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. §120, 121 or 365(c). (35 U.S.C. 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. §119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

WARNING., When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any non-provisional application claiming benefit of the provisional application must be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. 1.78(a)(3).

☐ The new application being transmitted claims the benefit of prior U.S. application(s) and enclosed are **ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED**.

3. **Papers Enclosed That Are Required for Filing Date under 37 CFR 1.53(b)**
(Regular) or 37 CFR 1.153 (Design) Application

27 Pages of specification

2 Pages of claims

1 Pages of Abstract

0 Sheets of drawing

☐ formal

☐ informal

WARNING: *DO NOT* submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. Comments on proposed new 37 CFR 1.84. Notice of March 9, 1988 (1990 O.G. 57-62).

NOTE: "Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm. (5/8 inch) down from the top of the page." 37 C.F.R. 1.84(c)).

(complete the following, if applicable)

- ☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. 1.84(b).

4. Additional papers enclosed

- ☐ Preliminary Amendment
- ☐ Information Disclosure Statement (37 CFR 1.98)
- ☐ Form PTO-1449
- ☐ Citations
- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

5. Declaration or oath

X Enclosed

Executed by

(check all applicable boxes)

X inventor(s).

- ☐ legal representative of inventor(s). 37 CFR 1.42 or 1.43.
- ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.

- ☐ This is the petition required by 37 CFR 1.47 and the statement required by 37 CFR 1.47 is also attached. See item 13 below for fee.

☐ Not Enclosed.

WARNING: Where the filing is a completion in the U.S. of an International Application, but where a declaration is not available, or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL, WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

☐ Application is made by a person authorized under 37 CFR 1.41(c) on behalf of all the above named inventor(s).

(The declaration or oath, along with the surcharge required by 37 CFR I. 16(e) can be filed subsequently).

NOTE: It is important that all the correct inventor(s) are named for filing under 37 CFR 1.41(c) and 1.53(b).

☐ Showing that the filing is authorized.
(not required unless called into question. 37 CFR 1.41(d))

6. Inventorship Statement

WARNING:: *If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted*

The Inventorship for all the claims in this application are:

☒ The same.

or

☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,

☐ is submitted.

☐ will be submitted.

7. Language

NOTE., An application including a signed oath or declaration may be filed in a language other than English. A verified English translation of the non-English language application and the processing fee of \$130.00 required by 37 CFR 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 CFR 1.52(d).

NOTE., A non-English oath or declaration in the form provided or approved by the PTO need not be translated. 37 CFR 1.69(b).

☒ English

☐ Non-English

☐ The attached translation is a verified translation. 37 CFR 1.52(d).

8. Assignment

☒ An assignment of the invention to **USG Interiors, Inc.**

☐ is attached. A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

☒ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters-one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

WARNING: A newly executed "CERTIFICATE UNDER 37 CFR 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, (1150 O.G. 62-64)

9. Certified Copy

Certified copy(ies) of application(s)

country	appln. no.	filed
country	appln. no.	filed
country	appin. no.	filed

from which priority is claimed

☐ is (are) attached.

☐ will follow.

NOTE The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 CFR 1.55(a) and 1.63.

NOTE This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

10. Fee Calculation (37 CFR 1.16)

A. ☒ Regular application

CLAIMS AS FILED

Number filed	Number Extra	Rate	Basic Fee 37 CFR 1.16(a) \$710.00
Total			
Claims (37 CFR 1.16(c)) 20	- 20 = 0	x \$ 18.00 =	\$0.00
Independent			
Claims (37 CFR 1.16(b)) 3	- 3 = 0	x \$ 80.00	\$0.00
Multiple dependent claim(s), if any (37 CFR 1.16(d))	0 0	x \$270.00	

☐ Amendment canceling extra claims enclosed.

☐ Amendment deleting multiple-dependencies enclosed.

☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims canceled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 CFR 1.16(d).

Filing Fee Calculation

\$710.00

B. ☐ Design application

(\$310.00-37 CFR 1.16(g))

Filing Fee Calculation

\$

C. ☐ Plant application

(\$510.00-37 CFR 1.16(g))

Filing Fee Calculation

\$

11. Small Entity Statement(s)

- ☐ Verified Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 is (are) attached.

WARNING: *"Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. A nonprovisional application claiming benefit under 35 U.S.C. 119(e), 120, 121 or 365(c) of a prior application may rely on a verified statement filed in the prior application if the nonprovisional application includes a reference to a verified statement in the prior application or includes a copy of the verified statement filed in the prior application if status as a small entity is still proper and desired. " 37 C.F.P. 1.28(a).*

(complete the following, if applicable)

- ☐ Status as a small entity was claimed in prior application

_____ / _____ filed on _____, from which benefit is being claimed for this application under:

- ☐ 35 U.S.C.119(e),
☐ 35 U.S.C.120,
☐ 35 U.S.C.121,
☐ 35 U.S.C.365[®],

and from which status as a small entity is still proper and desired.

- ☐ A copy of the verified statement in the prior application is included.

Filing Fee Calculation (50% of A, B or C above)

\$

NOTE: *Any excess of the full fee paid will be refunded if a verified statement and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendible under §1.136. 37 CFR 1.28(a).*

12. Request for International-Type Search (37 CFR 1.104(d))

(Complete, if applicable)

- ☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made at This Time

- ☐ Not Enclosed
☐ No filing fee is to be paid at this time.
(This and the surcharge required by 37 CFR 1.16(e) can be paid subsequently.)

X Enclosed

- X** Basic filing fee \$710.00
- ☐ Recording assignment
(\$40.00; 37 CFR 1.21(h))
(See attached "COVER SHEET FOR
ASSIGNMENT ACCOMPANYING NEW APPLICATION".) \$
- ☐ Petition fee for filing by other than all the
inventors or person on behalf of the inventor where
inventor refused to sign or cannot be reached.
(\$130.00; 37 CFR 1.47 and 1.17(h)) \$
- ☐ For processing an application with a
specification in
a non-English language. (\$130.00; 37 CFR
1.52(d) and 1.17(k)) \$
- ☐ Processing and retention fee
(\$130.00; 37 CFR 1.53(d) and 1.21(l)) \$
- ☐ Fee for international-type search report
(\$40.00; 37 CFR 1.21(e)) \$

NOTE: 37 CFR 1.210) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 CFR 1.53(d) and this, as well as the changes to 37 CFR 1.53 and 1.78, indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of 1.21(l) must be paid, within 1 year from notification under 53(d).

Total fees enclosed \$710.00

14. Method of Payment of Fees

- X** Check in the amount of \$710.00
- ☐ Charge Account No. 05-0461 in the amount of \$710.00
A duplicate of this transmittal is attached.

NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37CFR 1.22(b).

15. Authorization to Charge Additional Fees

WARNING:- If no fees are to be paid on filing, the following items should not be completed.

WARNING:- Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

☒ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No.21-0425

☒ 37 CFR 1.16(a), (f) or (g) (filing fees)

☒ 37 CFR 1.16(b), (c) and (d) (presentation of extra claims)

NOTE. Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims canceled by amendment prior to the expiration of the time period set by the PTO in any notice of fee deficiency (37 CFR 1.16(d)), it might be best not to authorize the PTO to charge additional fees, except possibly when dealing with amendments after final action.

☐ 37 CFR 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☐ 37 CFR 1.17 (application processing fees)

WARNING: While 37 CFR 1.17(a), (b), (d) deal with extensions of time under § 1.136(a), this authorization should be made only with the knowledge that, 'Submission of the appropriate extension fee under 37 C.F.R. 1.136(a) is to no avail unless a request or petition for extension is filed.' (Emphasis added). Notice of Alo@ 5, 1985 (1060 O.G. 27).

☐ 37 CFR 1.18 (issue fee at or before mailing of Notice of Allowance pursuant to 37 CFR 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the Notice of allowance. 37 CFR 1.311(b),

NOTE: 37 CFR 1.28(b) requires "Notification of any change in Am of entitlement to small entity status must be filed in the application... prior to paying or at the time of paying, . . . issue fee" From the wording of 37 CFR 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than as a small entity and (b) no notification is required if the change is to another small entity.

16. Instructions as to Overpayment

☒ Credit Account No. 05-0461

☐ Refund

SIGNATURE OF ATTORNEY

Donald E. Egan

Attorney at Law

17 West 200 22nd Street

Oakbrook Terrace, IL 60181

Registration No: 28,620

(630) 782-1900

☐ **Incorporation by reference of added pages**

(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-1-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)

☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added

☐ Plus **Added** Pages for Papers Referred to in Item 4 Above

Number of pages added

☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added

X Statement Where No Further Pages Added

*(If no further pages form a part of this Transmittal, then end this Transmittal with this **page** and check the following item.)*

X This transmittal ends with this page.

ACOUSTICAL TILE CONTAINING WET-STRENGTH RESIN

FIELD OF THE INVENTION

This invention relates to compositions containing a wet-strength
5 resin, which are useful in manufacturing acoustical tiles and panels for
ceiling and other applications using a water felting process. More
particularly, this invention relates to acoustical tile compositions in
which the conventional starch binder is replaced by a wet-strength
resin, such as a polyamine epichlorohydrin resin, to provide
10 compositions that can be fabricated into tiles and panels using
conventional water felting processes and equipment with improved
efficiency. Still more particularly, this invention relates to acoustical
tile compositions, which include polyamine epichlorohydrin resins,
which can be efficiently fabricated into ceiling tiles and panels, which
15 can be dried significantly faster than comparable compositions
containing conventional starch binders.

BACKGROUND OF THE INVENTION

The water felting of dilute aqueous dispersions of mineral wool
20 and/or lightweight aggregate is a well-known commercial process for
manufacturing acoustical ceiling tile. In this process, an aqueous
slurry of mineral wool, lightweight aggregate, cellulosic fiber, starch

binder and other ingredients, as desired or necessary, is flowed onto a moving foraminous support wire, such as that of a Fourdrinier or Oliver mat forming machine, for dewatering. The slurry may be first dewatered by gravity and then dewatered by vacuum suction means to form a basemat. The wet basemat is then pressed (with or without the application of additional vacuum) to the desired thickness between rolls and the support wire to remove additional water. The pressed basemat is then dried in heated drying ovens, and the dried material is cut to the desired dimensions and optionally sanded and/or top coated, such as with paint, to produce acoustical ceiling tiles and panels.

Mineral wool acoustical tiles are very porous which is necessary to provide good sound absorption. The prior art (e.g. U.S. Patent Nos. 3,498,404; 5,013,405; 5,047,120 and 5,558,710) also discloses that mineral fillers may be incorporated into the composition to improve sound absorbing properties and to provide lightweight acoustical tiles and panels.

Acoustical tile compositions must contain a binder and usually employ starch as the binder. The prior art (e.g. U.S. Patents 5,911,818 and 5,964,934) suggest that as much as 15% by weight of the composition may be starch although about 6 or 7% by weight is conventionally used.

The prior art (e.g. U. S. Patent 5,250,153) also describes the use of latex binders for acoustical tile compositions and a wide variety of vinyl latex binders have been suggested for this purpose.

It is an object of this invention to provide an acoustical tile
5 composition wherein a wet-strength resin such as a polyamine
epichlorohydrin resin replaces the conventional starch binder and the
resulting composition may be more efficiently fabricated into
acoustical tiles and panels in a water felting process.

It is a further object of this invention to provide an acoustical tile
10 composition wherein the conventional starch binder is replaced by a
polyamine epichlorohydrin resin to provide compositions that may be
more efficiently fabricated into acoustical tiles and panels having
improved performance in high humidity conditions. These and other
objects will be apparent to persons skilled in the art in view of the
15 description that follows.

SUMMARY OF THE INVENTION

The present invention relates to compositions containing a wet-
strength resin, which compositions are useful in manufacturing
20 acoustical tiles and panels for ceiling and other applications using a
water felting process. More particularly, this invention relates to
acoustical tile compositions in which the conventional starch binder is

replaced by a wet-strength resin, such as a polyamine epichlorohydrin resin, to provide compositions that can be fabricated into tiles and panels using conventional water felting processes and equipment with improved efficiency. Still more particularly, this invention relates to

5 acoustical tile compositions, which include polyamine epichlorohydrin resins, which can be efficiently fabricated into ceiling tiles and panels that can be dried significantly faster than comparable compositions containing conventional starch binders.

The present invention is based on the discovery that a ceiling

10 tile fabricated from an acoustical tile composition containing the conventional level of a starch binder, typically about 7% by weight of starch, requires a significant amount of heat to dry. It has been found that when a wet-strength resin such as a polyamine epichlorohydrin resin replaces the conventional starch binder in the acoustical tile

15 composition the resulting tile requires significantly less heat to dry. Further it has been found that substituting a polyamine epichlorohydrin resin in the acoustical tile composition (for all or part of) the conventional starch binder produces ceiling tile having improved properties, such as improved high humidity sag-resistance. The

20 acoustical tile compositions of the present invention also contain lightweight aggregate, cellulosic fiber, in addition to the polyamine epichlorohydrin resin binder. The composition of the present invention

may also contain conventional materials such as mineral fiber and fillers such as clay, gypsum and limestone.

The acoustical tile compositions of this invention must include a lightweight aggregate such as expanded perlite. The acoustical tile compositions of the present invention must also contain cellulosic fiber that may comprise waste newsprint and/or waste (scrap) acoustical tiles and panels, which are environmentally friendly. The acoustical tile compositions may also contain a reduced amount of mineral wool or may contain no mineral wool. The dried product can be formed into tiles or panels having acoustical properties comparable to those of commercially available acoustical tiles. The acoustical tiles made from the compositions of this invention have acceptable physical properties for use in suspended ceiling systems.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to an acoustical tile composition wherein the conventional starch binder is replaced by a wet-strength resin such as a polyamine epichlorohydrin resin to provide a composition that can be used in a water felting process to make ceiling tile. The water felting process to which the present invention pertains comprehends the formation of an aqueous dispersion comprising lightweight aggregate, cellulose fiber and a polyamine

epichlorohydrin resin binder with sufficient water to make the dispersion to be flowable. The aqueous dispersion is flowed onto a moving foraminous support wire where it forms a cake, which is dewatered through a combination of gravity and vacuum dewatering.

- 5 The dewatered cake is then pressed (with or without the application of additional vacuum) to a given thickness to form a basemat. The pressing step (with or without the application of additional vacuum) further dewateres the basemat. The basemat is then passed into a drying kiln in which the moisture in the basemat is reduced to less
10 than 5% and preferably less than 1% in the final product.

- The acoustical tile compositions of this invention must include a lightweight aggregate such as expanded perlite and cellulosic fiber and a polyamine epichlorohydrin resin binder. In the preferred embodiment, the composition of the present invention may additionally
15 include mineral fiber and clay filler. The present invention is not limited to any precise amounts of materials. In general, the present invention contemplates compositions containing the following components in the amounts shown in Table 1.

TABLE 1

Ingredient	Useable Range	Preferred Range	Preferred Percentage
Perlite	Up to 75%	15 to 70%	50%
Cellulosic Fiber	Up to 25%	3 to 20%	18%
Filler	0 to 25%	0 to 20%	20%
Mineral Fiber	0 to 85%	5 to 65%	5%
Starch	0 to 15%	0 to 8%	0%
polyamine epichlorohydrin resin binder	0 to 7.5%	1 to 4%	2.5%
Total			100%

Replacement of the starch with polyamine epichlorohydrin resin in a conventional acoustical ceiling tile composition enables the product to be dried faster and allows the entire water felting line to be run at higher speed.

THE WET STRENGTH RESIN

The wet strength resin used in the present invention is selected from a class of products based on the reaction of an amino polyamide and epichlorohydrin. This reaction results in the formation of azetidinium groups, which are responsible for the cationic character and reactivity of the wet strength resin. These compounds are used

universally in the paper industry to provide wet strength to paper.

Although a variety of wet-strength resins may be used in the compositions of the present invention, the resin selected must meet four requirements to be effective, namely, it must be 1) water soluble, 2) cationic, 3) polymeric and 4) reactive. The requirement for water solubility allows the resin to be readily dispersed in an aqueous system. A cationic charge on the resin is necessary for retention of the resin in the water felting process. The polymeric nature of the resin is necessary so that the resin can bridge fibers and form a polymeric network within the forming mat. A suitable resin must be reactive so that it can form bonds with the carboxyl groups on the cellulose and with itself.

The preferred wet strength resin must meet four requirements in order to be effective as a wet strength resin. First, the polymeric backbone of the wet strength resin must be made cationic typically by the presence of positively charged azetidinium groups. These groups provide both water solubility as well as a cationic charge to the backbone. The resin must also be capable of cross-linking. This type of resin actually imparts wet strength by 1) crosslinking with the cellulose by the formation of resin-cellulose bonds and/or 2) providing a protection of fiber-fiber contacts by a network of cross-linked resin molecules that do not necessarily react with cellulose. Crosslinking is

The preferred wet strength resin is a polyamine epichlorohydrin resin sold by Hercules, Inc. under the name Kymene 557H. Kymene 557H is a high-efficiency, cationic wet-strength resin used commonly in papermaking to impart wet strength. Other commercially available wet strength resins include Cal-Zet 40, an amino-polyamide-epichlorohydrin wet strength additive produced by the Callaway Chemical Company. Products with similar chemistry are offered by Cytec (Parez® brand WSA resins), Henkel (Fibrabon® brand WSA resins), Georgia-Pacific (Amres® brand WSA resins) and others.

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wet strength resin. It is this agglomerate of resin and retention aid that is then retained within the forming basemat as water is removed during the forming process.

It has been found that retention of the wet strength resin is improved by the addition of Hercules Aqualon D-3378, a guar-based product with both cationic and anionic functionality, or Hercules CMC-7MT, a technical grade of sodium carboxymethylcellulose (CMC), or Nalco N 8677 Plus, a low molecular weight anionic polyacrylic water-soluble resin. Other retention aids which function to "tie up" the soluble cationic wet strength resin may be used in the composition of the present invention.

OTHER COMPONENTS

One major component in the novel acoustical tile composition of this Invention is lightweight aggregate. It is well known in the art to use expanded perlite in acoustical tile compositions. Expanded perlite and other lightweight aggregate materials have been used in acoustical tile because of their low cost and low density (e.g. 3 to 8 pounds per cubic foot). The lightweight aggregate provides bulking, and porosity in the composition that enhances acoustical properties. It has been found that a low density (i.e., 3-8 pcf) expanded perlite provides sufficient bulking and porosity.

A second major component in the novel acoustical tile compositions of this invention is the cellulosic fiber, which serves as a bulking agent. The cellulose fiber may also function as a binder and may help to retain fines. Several types of cellulosic fiber have been
5 evaluated in these compositions. It is well known to use newsprint in acoustical tile formulations, and both hammer-milled and hydro-pulped newsprint have been evaluated in these compositions. Refined paper fibers and wood fiber may also be used as the source of the cellulosic fiber, however, it has been found that ceiling tiles made with wood
10 fiber, either softwood or hardwood, are more difficult to cut with a knife at the installation site. Furthermore, wood fibers are a more expensive source of the cellulosic fiber.

The third essential component is the binder component, which is an essential component. The binder must be a wet strength resin
15 such as a polyamine epichlorohydrin resin. The use of a wet strength resin as a complete replacement for the starch is preferred as this provides the maximum reduction in drying time although lesser degrees of substitution are possible.

A fourth preferred component, which also is not novel in
20 acoustical compositions, is clay. It is deemed essential to use at least 4% and preferably at least 10 % by weight of clay in the ceiling tile formulation in order to impart fire resistance (as defined by ASTM Test

No E119) because the clay sinters during the fire endurance test.

Clays that may be used include CTS-1 from KT Clay of Sledge, MS, CTS-2 from KT Clay of Sledge, MS, Spinks Clay from Gleason, TN and Old Hickory Clay from Hickory, KY. Other commercial clays such
5 as Kaolin and Bentonite etc. can be used in the ceiling tile formulation.

In addition, the acoustical compositions of this invention may also contain mineral wool of the type conventionally used in acoustical tiles, inorganic fillers such as mica, wollastonite, silica, gypsum, stucco and calcium carbonate, other lightweight aggregates, surfactants and
10 flocculants. These ingredients are well known to those skilled in the art of the preparation of acoustical tile compositions. As noted above, the composition may contain some mineral wool (in reduced amount), however, it has been found that the compositions of this invention can be used to make mineral wool-free acoustical tiles and panels.

15

EXAMPLES

The following examples will serve to illustrate the preparation of several acoustical tile compositions within the scope of the present invention. It is understood that these examples are set forth for
20 illustrative purposes and that many other compositions are within the scope of the present invention. Those skilled in the art will recognize that similar acoustical tile compositions may be prepared containing

other quantities of materials and equivalent species of materials than those illustrated below.

EXAMPLE 1

5

Three lab boards were prepared using the materials shown in Table 2, below. Test Boards 1 and 2 contained a wet strength resin, Kymene 557H from Hercules in the amounts shown in Table 2.

10 Aqualon D-3378, a guar-based product with both cationic and anionic functionality produced by Hercules, was added as a retention aid at a level of 40% by weight, based on the weight of Kymene 557H solids. Table 2 presents the materials in percentages on a dry basis.

TABLE 2

Material	Control Board	Test Board 1	Test Board 2
Mineral wool	25.00	25.77	25.25
Perlite	50.00	51.55	50.51
Recycled Newspaper	18.00	18.56	18.18
Starch	7.00	0.00	0.00
Kymene 557H	0.00	4.12	6.06
Cytec 184 Polyacrylamide Flocculant	0.08	0.00	0.00
Aqualon D-3378 Guar based flocculant	0.00	1.65	2.42
Total	100.08	101.65	102.42

- 5 All samples were dried with steam for 30 minutes with the temperature ramping up to 600°F to insure full cooking of the starch. This was followed by 3 hours of 300°F drying without steam. Physical tests were run on the boards described in table 2. The test results are shown in Table 2A, below:

10

TABLE 2A

Test	Control Board	Test Board 1	Test Board 2
Density (pcf)	11.67	10.99	10.93
MOR (psi)	95	100	99
Corrected MOR* (psi)	100	119	120
Hardness (lbs.)	124	118	123
Loss on Ignition	22.34%	18.47%	19.51%
Binder retained	89.38%	83.94%	81.29%

* Corrected MOR values utilize a standard density of 12 pcf.

5

EXAMPLE 2

Six lab boards were prepared using the materials shown in Table 3, below. Test Boards 3-7 contained 6% by weight of wet strength resin, Kymene 557H from Hercules, and from 10% to 40% by weight of Aqualon D-3378, a guar-based product with both cationic and anionic functionality produced by Hercules. Table 3 presents the materials in percentages on a dry basis.

TABLE 3

Material	Control Board	Test Board 3	Test Board 4	Test Board 5	Test Board 6	Test Board 7
Mineral wool	25.00	25.10	24.95	24.80	24.65	24.51
Perlite	50.00	50.20	49.90	49.60	49.31	49.02
Newspaper scrap	18.00	18.07	17.96	17.86	17.75	17.65
Starch	7.00	0.00	0.00	0.00	0.00	0.00
Kymene 557H	0.00	6.02	5.99	5.95	5.92	5.88
Cytec 184	0.08	0.00	0.00	0.00	0.00	0.00
Aqualon D-3378	0.00	0.60	1.20	1.79	2.37	2.94
Total	100.08	100.00	100.00	100.00	100.00	100.00

All samples were dried with steam for 30 minutes with the temperature ramping up to 600°F to insure full cooking of the starch.

- 5 This was followed by 3 hours of 300°F drying without steam. Physical tests were run on the boards described in table 3. The results are shown below in Table 3A.

TABLE 3A

Test	Control Board	Test Board 3	Test Board 4	Test Board 5	Test Board 6	Test Board 7
Density (pcf)	11.57	10.94	10.97	10.27	10.79	11.17
MOR (psi)	92	50	65	76	89	132
Corrected MOR* (psi)	99	60	78	104	110	153
Hardness (lbs.)	91	74	87	92	109	108
Loss on Ignition (%)	20.67	17.35	17.23	19.59	18.74	19.01
Binder retained (%)	82.68	72.30	71.79	81.64	78.09	79.19

Corrected MOR values utilize a standard density of 12 pcf.

5

EXAMPLE 3

Six lab boards were prepared using the materials shown in Table 4, below. Test Boards 8-12 contained various amounts of weight of wet strength resin, Kymene 557H from Hercules. Aqualon CMC-7MT, a carboxymethylcellulose (CMC) produced by Hercules, was added as a retention aid at a level of 40% by weight, based on the weight of Kymene 557H solids. Table 4 presents the materials in percentages on a dry basis.

15

TABLE 4

Material	Control Board	Test Board 8	Test Board 9	Test Board 10	Test Board 11	Test Board 12
Mineral wool	25.00	26.48	26.10	25.72	25.35	25.35
Perlite	50.00	52.97	52.19	51.44	51.71	50.71
Newspa per scrap	18.00	19.07	18.79	18.52	18.26	18.26
Starch	7.00	0.00	0.00	0.00	0.00	0.00
Kymene 557H	0.00	1.06	2.00	3.09	4.06	5.07
Cytec 184	0.08	0.00	0.00	0.00	0.00	0.00
Aqualon CMC-7MT	0.00	0.42	0.84	1.23	1.62	1.67
Total	100.08	100.00	100.00	100.0	100.0	100.0

All samples were dried with steam for 30 minutes with the temperature ramping up to 600°F to insure full cooking of the starch.

- 5 This was followed by 3 hours of 300°F drying without steam. Physical tests were run on the boards described in table 5. The results are shown below in Table 4A.

TABLE 4A

Test	Control Board	Test Board 8	Test Board 9	Test Board 10	Test Board 11	Test Board 12
Density	11.40	10.84	10.06	10.76	11.14	10.96
MOR	87	61	48	94	104	95
Corrected MOR*	96	75	68	117	121	114
Hardness	117	90	71	105	101	108

Corrected MOR values utilize a standard density of 12 pcf.

- 5 Examples 1 to 3 illustrate that it is possible to replace the 7% starch in a conventional acoustical tile composition with 2.5% of a wet strength resin and achieve equivalent or even slightly improved physical properties. These results were achieved while retaining only about 60% of the wet strength resin in the test boards. With improved
- 10 retention of the wet strength resin, it should be possible to achieve physical properties equivalent to 7% starch using only 1.4% wet strength resin.

Preparation of Lab Boards

1. Combine water, mineral wool, starch, perlite, and newsprint
- 15 2. Mix at highest mixer setting for 3.0 minutes.
3. Add polyamine epichlorohydrin resin (if required) and mix sufficiently to achieve a homogeneous mix.

4. Add flocculant; mix for 5 seconds.
5. Set up TAPPI box with a piece of nonwoven scrim on top of the wire.
6. Prefill TAPPI box with water to just cover the nonwoven
5 scrim.
7. Pour stock into TAPPI box.
8. Apply gravity drainage.
9. Apply 5 seconds of 20"Hg vacuum.
10. Weight formed mat. Arrange mat between pieces of plastic
10 wire and perforated plate.
11. Transfer to hydraulic press. Press mat to desired thickness.
Weigh.
12. Dry to constant weight.

15

EXAMPLE 4

Two identical pilot line runs were conducted using the formulations shown in Table 5, below. The first run was made using a standard formula using a starch binder. The second run was made
20 using a formulation that contained 2.5% by weight of a wet strength resin, Kymene 557H from Hercules. Table 5 presents the materials in percentages on a dry basis.

TABLE 5

Material	Run #1	Run #2
Perlite	50.00	50.00
Mineral wool	25.00	25.00
Starch	7.00	0.00
Newspaper scrap	18.00	18.00
Kymene 557H	0.00	2.50
Aqualon CMC-7MT	0.00	1.00
Nalco 7520 Polyacrylamide Flocculant	0.08	0.00
Total	100.08	96.50

All samples were dried with steam for 30 minutes with the temperature ramping up to 600 F to insure full cooking of the starch.

- 5 This was followed by 3 hours of 300 F drying without steam. Physical tests were run on the boards described in table 5A. The average test results are shown in Table 5A, below:

TABLE 5A

Test	Run #1	Run #2
Sag @ 90°/90% RM	0.097	0.084
Sag @ 75°/10% RM	0.092	0.078
Sag @ 70°/50% RM	0.096	0.082
Loss on Ignition	18.25	16.07

The other physical properties of the products were comparable.

5

EXAMPLE 5

Lab boards were prepared containing six varying amounts and types of binder to compare the effects that starch level and wet strength resin level have on the drying properties of the water-felted acoustical ceiling product. Lab boards were prepared using five different amounts of a starch binder as described below in Table 6, in order to demonstrate the effect that the amount of starch had on the drying rate. The drying rates for the boards with the starch binder were compared to boards prepared using 2.5% of a wet strength additive, Kymene 557H from Hercules.

15

TABLE 6

Board Number	Binder
1	7% Starch
2	5% Starch
3	3% Starch
4	1% Starch
5	No Starch
6	2.5% Kymene 557H; No Starch

The composition of Board #1, containing 7% starch is shown below in Table 7.

5

TABLE 7

Component	Dry Weight – grams	Dry Percent
Mineral Wool	11.70	9.00
Perlite	74.10	57.00
Newsprint	24.70	19.00
Starch-Pearl	9.10	7.00
Sodium Bicarbonate	10.40	8.00
Total	130.00	100.00

The components were mixed with 3300 grams of water for 5 minutes to give a stock consistency of 4.0%. This gave a Theoretical
 10 Oven Dry Weight of 130.0 grams. Although the percentage of binder

was varied in boards 1 through 6, the weights for all of the other components were kept constant.

In the commercial water-felting process for manufacturing ceiling tile using a starch binder, the starch must be fully cooked to effectively function as a binder. In order to replicate the temperature and humidity conditions under which ceiling tile is manufactured in a commercial water felting process, all of the test boards were pre-steamed at 300°F for 30 minutes prior to drying. The pre-steaming step was accomplished by wrapped the wet board in a piece of aluminum foil and placing the wrapped board in a pre-heated 300°F oven for 30 minutes. This procedure insures that the starch is fully cooked prior to initiating drying.

After each lab board was pre-steamed, it was placed on a support frame inside the tunnel oven capable of monitoring the weight of the board. The support frame rested on a balance located directly below the oven. The weight of the basemat was monitored during the entire drying process. Using this set-up, a drying profile was obtained for each trial board. The drying times reported were taken as the time required to remove 98% of the total water content (leaving a 2% moisture content). The results of the drying studies are presented below in Table 8.

TABLE 8

BOARD #	Thickness (inches)	Density (pcf)	Moisture Content (%)	Drying Time (min)
1A	0.667	11.3	71.6	82.8
1A	0.667	10.9	73.3	80.9
2	0.665	10.9	73.0	80.7
3	0.667	10.6	72.4	68.2
4	0.661	10.5	72.8	57.7
5A	0.663	10.5	74.7	51.3
5B	0.662	10.4	73.8	54.3
6A	NA	NA	NA	52.0
6B	0.659	10.7	71.3	51.7

The percent decrease in drying time is calculated, using the measured drying times of the boards, and using the drying time of Board #1 containing 7% starch as the base figure. The theoretical percent linespeed increase is calculated, using the average of the measured drying times of the boards, and using the average drying time of Board #1 containing 7% starch as the base figure. Both of these calculated values are shown below in Table 9.

TABLE 9

Board #	Drying Time (Average min)	Decrease in Drying Time (%)	Increase in Linespeed (%)
1	81.85		
2	80.7	1.4%	1.4%
3	68.2	16.7%	20.0%
4	57.7	29.5%	41.9%
5	52.8	35.5%	55.0%
6	51.85	36.7%	57.9%

The results presented above confirm that replacing starch with a wet strength resin has a dramatic effect on the drying rate of the acoustical ceiling tile. As shown below, a typical acoustical ceiling tile without starch will dry approximately 36% faster than a similar board prepared using 7% starch.

The drying studies conducted using 2.5% polyamine epichlorohydrin wet strength resin demonstrate that 2.5% of wet strength resin (1.4% retained polyamine epichlorohydrin resin) provides physical strength equal to the physical strength provided by 7% starch with a drying time is equivalent to a board made without starch. Thus a basemat made using 2.5% polyamine epichlorohydrin resin dries approximately 36% faster than a similar board prepared using 7% starch that has been cooked in the dryer. This again

corresponds to a potential linespeed increase through the dryer of 56%.

The forms of invention shown above and described herein are to be considered only as illustrative. It will be apparent to those skilled
5 in the art that numerous modifications may be made therein without departing from the spirit of the invention and the scope of the appended claims.

USG3325

I Claim:

1. A composition suitable for making acoustical tiles in a water-
5 felting process, said composition comprising a lightweight aggregate,
cellulosic fiber, a reactive water-soluble polymer binder and,
optionally, mineral wool.
2. The composition described in claim 1, wherein said binder
has a cationic charge.
- 10 3. The composition described in claim 2, wherein said binder
has positively charged azetidinium groups.
4. The composition described in claim 3, wherein said binder is
a polyamine epichlorohydrin resin binder.
5. The composition described in claim 4 comprising up to 4.0%
15 of polyamine epichlorohydrin resin based on the dry weight of the
composition.
6. The composition described in claim 5 comprising about
2.5% of polyamine epichlorohydrin resin based on the dry weight of
the composition.
- 20 7. The composition described in claim 1, wherein said binder
comprises a reactive water-soluble cationic polymer and starch.
8. The composition described in claim 1, comprising retention
aid that promotes aggregation.

9. The composition described in claim 8, wherein said retention aid is a polymeric material that possesses a residual negative charge.

10. The composition described in claim 8, wherein said
- 5 retention aid is selected from the group consisting of a guar-based product with both cationic and anionic functionality, sodium carboxymethyl cellulose, a water-soluble low molecular weight anionic polyacrylic resin and mixtures thereof.

ABSTRACT

Disclosed is an acoustical tile composition in which the conventional starch binder is replaced by a wet-strength resin, such as a polyamine epichlorohydrin resin, can be fabricated into ceiling tiles and panels using conventional water felting processes and equipment with improved efficiency. The acoustical tile compositions, with the polyamine epichlorohydrin resins binder, can be dried significantly faster than comparable compositions containing conventional starch binders.

USG-3325

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,
CONTINUATION OR C-I-P)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

(check one applicable item below)

- ☒ original.
- ☐ design.
- ☐ supplemental.

NOTE., If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item, check appropriate one of last three items.

- ☐ national stage of PCT.

NOTE. If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.

- ☐ divisional.
- ☐ continuation.
- ☐ continuation-in-part (C-I-P).

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation on of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (*if only one name is listed below*) or an original, first and joint inventor (*if plural names are listed below*) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

ACOUSTICAL TILE CONTAINING WET-STRENGTH RESIN

SPECIFICATION IDENTIFICATION

the specification of which:

(complete (a), (b) or (c))

(a) ☒ is attached hereto.

NOTE : "The following combinations of information supplied in an oath or declaration filed on the application filing date with a specification are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 CFR 1.63:

"(1) name inventor(s), and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration on filing;

*"(2) name of inventor(s). and attorney docket number which was on the specification as filed;
or*

"(3) name of inventor(s), and title which was on the specification as filed"

Notice of July 13, 1995 (1177 O.G. 60)

(b) ☐ was filed on _____, as ☐ Serial No. 0__ / _____

or ☐ _____

and was amended on _____ (if applicable)

NOTE: Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67,

NOTE: "The following combinations of information supplied in an oath or declaration filed after the filing date are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 CFR 1.63:

"(1) name of inventor(s), and application number (consisting of the series code and the serial number, e.g., 08/123,456);

"(2) name of inventor(s), serial number and filing date;

"(3) name of inventor(s) and attorney docket number which was on the specification as filed;

"(4) name of inventor(s), title which was on the specification as filed and filing date;

"(5) name of inventor(s), title which was on the specification as filed and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration; or

"(6) name of inventor(s), title which was on the specification as filed and accompanied by a cover letter accurately identifying the application for which it was intended by either the application number (consisting of the series code and the serial number, e.g., 08/123,456), or serial number and filing date. Absent any statement(s) to the contrary, it will be presumed that the application filed in the PTO is the application which the inventor(s) executed by signing the oath or declaration."

Notice of July 13, 1995 (1177 O.G. 60).

(c) ☐ was described and claimed in PCT International Application No.

_____, filed on _____ and as amended under PCT
Article 19 on _____ (if any).

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

(also check the following items, if desired)

- ☒ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important In deciding whether to allow the application to issue as a patent, and
- ☐ in compliance with this duty, there is attached an Information disclosure statement, in accordance with 37 CFR 1.98.

PRIORITY CLAIM (35 U.S.C. § 119(a)-(d))

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 (a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority Is claimed.

(complete (d) or (e))

- (d) ☒ no such applications have been filed.
- (e) ☐ such applications have been filed as follows.

NOTE: Where item (e) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

**PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)**

COUNTRY (OR INDICAT IF PCT)	APPLICATION NUMBER	Date of Filing (day, month, year)	PRIORITY CLAIMED UNDER 35 USC §119
	NONE		<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

**CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(35 U.S.C. § 119(e))**

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER

FILING DATE

____ / _____
 ____ / _____
 ____ / _____

**CLAIM FOR BENEFIT OF EARLIER US/PCT APPLICATION(S)
UNDER 35 U.S.C. §120**

☐ The claim for the benefit of any such applications are set forth in the attached ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN PART (C-1-P) APPLICATION

**ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION**

NOTE: If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL., CONTINUATION OR C-1-P APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S. C. §120.

POWER OF ATTORNEY

I hereby appoint the following attorney to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Donald E. Egan	Registration No. 19,691
John M. Lorenzen	Registration No. 25,889
David F. Janci	Registration No. 28,620

(check the following Item, if applicable)

☐ Attached, as part of this declaration and power of attorney, is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO:

DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

Donald E. Egan
Attorney at Law
17 West 200 22nd Street
Oakbrook Terrace, IL 60181
Registration Number 19691

Donald E. Egan
Telephone Number (630) 782-1900

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or Imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

)

SIGNATURE(S)

NOTE., Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other documents

Full name of sole or first Inventor

Mark H. Englert
(GIVEN NAME) (MIDDLE INITIAL OR NAME) FAMILY (OR LAST NAME)

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Inventor's signature: _____

Date: _____

Country of Citizenship: _____

Residence: _____

Post Office Address: _____

Full name of third joint Inventor, if any

(GIVEN NAME) (MIDDLE INITIAL OR NAME) FAMILY (OR LAST NAME)

Inventor's signature: _____

Date: _____

Country of Citizenship: _____

Residence: _____

Post Office Address: _____

(check proper box(es) for any of the following added page(s)
that form a part of this declaration)

- ☐ **Signature** for fourth and subsequent joint Inventors. *Number of pages added*

- ☐ **Signature** by administrator(trix), executor(trix) or legal representative for deceased or incapacitated Inventor. *Number of pages added* _____
- ☐ **Signature** for Inventor who refuses to sign or cannot be reached by person authorized under 37 CFR §1.47. *Number of pages added* _____
- ☐ Added page for **signature** by one joint inventor on behalf of deceased inventor(s) where legal representative cannot be appointed in time. (37 CFR §1.47)
- ☐ Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (C-1-P) application.
☐ Number of pages added _____
- ☐ Authorization of attorney(s) to accept and follow instructions from representative.

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